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## **ECONOMETRIC MODELS USED FOR THE CORRUPTION ANALYSIS**

***Abstract.** The article conveys a series of features of the public administration by using some econometric models. In order to estimate the parameters, we used a series of data registered from an illustrative sample of civil servants. With the aim of analysing the corruption, there are used various regression and simultaneous equation models. The corruption level is analysed depending on a series of factors such as the political system pressure, the administration transparency, the quality of the civil servants' job-related relationships.*

**Key words:** *corruption, public administration, regression models.*

**JEL Classification: C20, H83**

### **1. INTRODUCTION**

The corruption analysis is a significant field of the economic research nowadays. Over the last years, the university and research environment, the international organizations (such as the International Monetary Fund, the World Bank and so on) have showed an increasing interest in estimating the corruption level, in identifying the causes, the mechanisms for transmitting it among the system and also an interest in measuring its impact over the economic and social processes of a country or development region.

Among the most important classic writings in this research area there are A. Krueger [1974], S. Rose-Ackerman [1975], Mauro [1995], Tanzi [1998] and so on. The period of time following the political and economic changes caused by the socialism's collapse in the Eastern Europe caused the appearance of new corruption forming factors and more and more refined mechanisms of transmitting it among the new transforming social systems. These new conditions stimulated the

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research development in this field. Furthermore, the World Bank (2001) identified the corruption as „the only significant obstacle in the economic and social development”. Over this period of time there have been published several remarkable articles concerning the quantitative analysis of the corruption economics. Some of the most important writings from the 90s are written by P. Mauro [1995], P. Bardhan [1997], V. Tanzi [1998], Shang-Jin Wei (1997).

A major aspect in analysing the corruption is identifying its causes in a public system. In the specialized literature there are identified four groups of factors that influence directly the corruption among a system: political, legal, historical, social, cultural and economic ones. The quality of the political system, the features of the legal system (Leite and Weidmann (1999)), especially the legislation and the institutions concerned with abolishing the corruption, the quality of the democratic system, the features of the electoral and the administrative system in a country fall into the category of political and legal factors.

A series of studies such as La Porta (1999), Treisman (2000) emphasize the influence of the traditions and historical factors over the corruption level in a country and the features of the mechanisms of forming and transmitting it. The social and cultural factors are significant in emphasizing the corruption features of a country (La Porta (1999), Treisman (2000), Alesina (2003)). On the other hand, the religious factors also have a significant part in spreading the corruption throughout a social system. The economic factors, such as the opening level of an economy (for instance Dreher (2003), Treisman (2000), Wei (2001)), the dimensions of the public sector (Tanzi (1998), Treisman (2000)), the salary level in the public sector (van Rijckeghem (1997)) etc. have a direct influence over the corruption level existing in a country.

Another major aspect of the corruption analysis is choosing the most appropriate econometric models in order to estimate its effects over some activity sectors. Among the most important research directions which are concerned with estimating the consequences of the corruption on the social and economic environment there are: (i) directions regarding the economic growth in general (Mauro [1995], Abed and Davoodi [2000], Krueger [1974]); (ii) directions with reference to some national economy sectors (Tanzi [1998], Shang-Jin Wei [2001]); (iii) directions concerning the effects of the decentralization process on the level and the mechanisms of transmitting the corruption throughout a system (Shah [2006]) and so on and so forth; (iv) directions regarding the quality of the finance systems of some activity sectors such as the military one, Gupta [2001], the salaries in the public sectors (van Rijckeghem and Weder [1997]); (v) directions concerning the industrial policies of a country (Emerson [2002], Bhagwati [1982]) and the efficiency of the investments (Sarkar [2001], Mauro [2002]). In most of the above mentioned writings, in order to estimate the impact of the corruption on

some economic and social aspects, there can be used regression models, VAR models, the analysis of integration series etc. Kaufman [1999] and Andrei [2008] propose using the simultaneous equation models with the view of estimating the effects of the corruption on the public administration processes in a country. In this case, the variables of the model fall into endogenous and exogenous ones, and the parameters are estimated by using the method of least squares in two stages (TSLS) and the general method of moments (GMM). By using these methods, the endogenous or exogenous type of each variable from the model is taken into consideration. With reference to this model we must mention the fact that in the specialized literature there is no convenient approach of choosing the tool variable list used to estimate the parameters of the simultaneous equations models utilised for the corruption analysis and its effects on the public administration reform (Andrei [2007], Profiroiu[2005], Teodorescu [2007a]), the corruption existing in the Romanian universities (Teodorescu [2006, 2007b]), and the consequences that the corruption has on the finance quality of some activity sectors (Andrei [2002] și Matei [2007]).

At present, the public administration in Romania is subject to an intense reform. According to the demands of the UE accession process, the public administration reform is defined through a series of reform measures which are being taken in the public sector through carrying on the decentralization process and improving the process of forming the public policies.

According to the reform strategy of the public administration, the decentralization process has a significant part in the fight against corruption. Nevertheless, when applying this process we must bear in mind the fact that the deficient implementation may lead to a local growth in corruption, with dire consequences on the social and economic environments, on both middle and long term.

## **2. THE DEFINITION OF THE MODEL**

In this writing, in order to define the analysis model of the reform process quality in the public administration, we have as a starting point Becker's [1968] approach to crime and punishment. Thus, the choice that one makes to commit a crime or an offence is inspired by the ratio between the benefits from the action and the losses caused by not doing it or the penalties suffered by its initiator if detected.

When defining the analysis model of the reform process quality, you must take into consideration the quantitative measurements of the results of some reform actions. Therefore, in this paper the public administration reform is defined corresponding to the reform strategy of the public administration adopted by Romania in 2004. We must mention that the administration reform process was recommended by both internal necessities and Romania's accession to the European Union. Thus, writing this document was possible with the direct support of the EU

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Comittee, by providing Romania through Phare 2001 with financial and technical assistance by means of the project “Support for realizing a strategy project for the public administration reform”.

According to the strategy adopted in 2004, the administration reform is a process of transforming the central and local public administration in order to comply with the demands of the beneficiaries of the sector and the severity of the accession to the European structures. From this point of view there have been identified three constituent parts of the reform process: (i) the reform of the public function, by improving its management, and the change for the better of the continuous forming process of the civil servants; (ii) the reform of the local public administration, by carrying on the decentralization process; (iii) the improvement of the expressing process of the public policies.

Under these circumstances, we define the public administration reform process starting from the next assumptions:

**[Hypothesis no. 1]** In order to support the reform process we have a reform strategy and a battle plan. By applying the battle plan we aim at achieving three specific objectives:  $O_1$  – on the short run, the actions regarding the public function have as a goal to improve the management of changes as far as the public function is concerned; on the long run, the aim is to stabilize and strengthen the public function system;  $O_2$  - in the field of local public administration reform we aim at approaching the public administration and the citizen and creating new mechanisms through which the central Government should have a better communication with the local public administrations;  $O_3$  - actions that should improve the quality of the expressing process of the national and local public policies which would strengthen the managerial capacity of the Government, the Local and District Councils, capacity which is useful for achieving the objectives and demands of the local and national development.

**[Hypothesis no. 2]** With the view of supporting the specific objectives, there are some precise activities within the framework of the battle plan which comes together with the reform strategy. In order to measure the positive effects of the AP reform process we define the following three functions:

$$R_i = R_i(A_{i1}, \dots, A_{ip_i}), \quad i = 1, 2, 3$$

where  $A_{ij}$ , with  $j = 1, \dots, p_i$ , represents the ensemble of planified actions with the view of supporting the specific objective  $O_i$ .  $p_i$  means the number of planified actions in order to support the specific objective.

There are 17 actions for the public function reform which aim at: (i) creating and applying a recruiting, valuating and promoting system mainly based on merits as far as the public function is concerned; (ii) creating and applying a

unitary salary system for the civil servants; (iii) enhancing the number of professional public managers and their skills which could serve supporting the reform process and the accession to the EU; (iv) consolidating the capacities of the National Administration Institute with the view of ensuring the application of the strategic parts of the continuous forming of the public servants. Besides that, there have been provided 25 activities for the field of local public administration reform, activities which concern: (i) the definition of the mechanisms and structures that are necessary for managing the evolution of the process; (ii) the reform of the Education, Health and Social assistance sector; (iii) the improvement of the local budget system; (iv) the income enhancement and the elucidation of the issues regarding the public property; (v) the improvement of the transfer system; (vi) the establishment of a new frame for the Prefect's activity and the development of some specialized training programmes for them; (vii) the development of the local authority capacity of undergoing the reforms by training the human resources, developing the standards and administrating the new decentralization services. In order to support the improvement of the public policies formulating we have provided 11 actions which aim at: (i) consolidating the government capacity on both central and local levels with the view of supporting the public policies formulating process; (ii) enhancing the role of the most important public servants in the public policies formulating process; (iii) improving the public policies formulating process; (iv) strengthening the coordination between the institution both on central and local levels in the public policies formulating process;

**[Hypothesis no. 3]** On middle and long term the reform actions that are part of the strategy will bring a benefit to the public administration by improving the quality of the services offered to the beneficiaries, reducing the costs of the public institutions functioning, supporting the development process on a national and local level, diminishing the corruption etc. Under these circumstances, the result will be that each function which values the positive effects of the reforms on the three fields will be directly influenced by the reform dimensions measured through the activity volume destined for each action within the strategy:

$$\frac{\partial R_i}{\partial A_j} > 0 \quad i = 1, 2, 3 \text{ și } j = 1, 2, \dots, p_i.$$

**[Hypothesis no. 4]** With the aim of supporting the reform process, financial resources were provided for the reform actions. These came from the state budget or external projects, mainly European ones, part of the Phare Programme which lasted from 2004 to 2006, or the PAL Programme of the World Bank. The financial resources fall into three priorities: (i) the public function: 7.200 thousand Euros. Besides that, 13.937,6 thousand Euros per year are added in order to form the following personnel categories over a period of three years: 100 major civil servants through specialization programmes lasting one year; 150 young

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professionals through specialization programmes lasting one or two years; 3000 actual top management civil servants through specialization programmes lasting one year and 9000 actual middle management civil servants through specialization programmes lasting three months. (ii) supporting the local public administration reform: projects with Phare or the World Bank finances of 8.150 thousand Euros; (iii) the third part: projects totalizing 8.150 thousand Euros. Moreover, from 1992 until the start of the 2004-2006 Phare programme the financial support from the European Union for the public administration reaches the sum of 42.000 thousand Euros. The value of the Phare projects from the 2004-2006 Phare programme which support the Strategy totalize 35.880 thousand Euros.

As far as the model used for analysing the reform process is concerned, the reform costs are given by the activities developed in order to support the reform process, by the positive reaction of the public administration system to the reform measures provided by the strategy document and by the system's losses due to the lack of political intention to apply some reform measures. Under these circumstances we define the cost of the reform process for each priority through the functions:

$$C_i = C_i(A_{i1}, \dots, A_{ip_i}, \mathbf{B}, \mathbf{P}) \quad i = 1, 2, 3$$

The vectorial variable  $\mathbf{B} = (B_1, \dots, B_q)$  values the positive reaction of the system to the reform process and the vectorial variable  $\mathbf{P} = (P_1, \dots, P_m)$  describes the political system's capacity of supporting the public administration reform process. The vectorial variable  $\mathbf{B}$  depicts the influence of various factors such as: the mobility of the public administration employees, the ability of the public administration to properly organize the competitions for filling in or promoting in the public function, the level of the informatic systems equipments within the public administration institutions and so on. The vectorial variable  $\mathbf{P}$  describes the direct or hidden actions of the political system over the public administration, such as: political insecurity in promoting some reform measures, the pressure of the political system on the public administration through different decision channels in order to gain some advantages, the corruption induced in the public administration by the central and local political class etc.

Under the circumstances of a normal reaction of the public administration system to the reform process, we are going to consider the functions

$C_i = C_i(\cdot) \quad i = 1, 2, 3$ , which have the following properties:

**(P1)** The larger the reform process, the bigger the costs of the reform process, represented by the amounts of money provided by projects either with national or international finances:

$$C'_{ij}(A) = \frac{\partial C_i}{\partial A_j} > 0.$$

**(P2)** The reform measures given by the strategy document ensures to a certain degree positive changes in the system. Thus, there is a series of risks which can slow down the reform process of the public administration. On the other hand, there is also a series of positive reactions, unpredictable when elaborating the strategy, which could diminish the reform costs and obtaining positive results within a shorter period of time than planned. Under these circumstances, the function used for measuring the costs will be decreasing and concave:

$$C'_{ij}(B) = \frac{\partial C_i}{\partial B_j} < 0 \quad C''_{ij}(B) = \frac{\partial^2 C_i}{\partial B_j^2} > 0.$$

**(P3)** For the vectorial variable **P**, which measures the political will of the political class to support the AP reform process, we will have one of the following situations:

$$C'_{ij}(P) = \frac{\partial C_i}{\partial P_j} > 0$$

if there is no political will to reform the AP, in which case the costs of the AP functioning are much higher than the situation of reforming it or

$$C'_{ij}(P) = \frac{\partial C_i}{\partial P_j} < 0,$$

if there is political will among the political class and this one effectively and efficiently communicates with the technical level from the APC and APL in order to apply the reform measures.

**[Hypothesis no. 5]** The net income obtained by developing the reform process is defined by the function:

$$CN = \sum_i (R_i(A_{i1}, \dots, A_{ip_i}) - C_i(A_{i1}, \dots, A_{ip_i}, \mathbf{B}, \mathbf{P}))$$

Actually, the net gain resulted due to the application of the reform measures is found in:

**(E1).** The increase in the AP capacity of accomplishing its stipulated basic functions.

**(E2).** The diminish in the AP and national corruption level.

**(E3).** The increase in the AP and national transparence.

**(E4).** The increase in the employees satisfaction within this activity sector.

Each one of the four endogenous variables are established by a series of factors. Within the study, taking into consideration the data series recorded from



the AP employees, there will be estimated the regression models parameters used in order to analyse the four endogenous variables. With the view of defining the models and applying some appropriate methods so as to estimate the parameters, we must bear in mind Kufmann's [2002] study. Thus, according to it, in the majority of the studies carried out in the public sector there are two major limits, which concern the models used for analysing some phenomena from this activity sector and the methods used to estimate the parameters. More exactly, the first objection refers to the fact that most of the studies which were carried out are based on regression models estimated on cross-country data. Secondly, the methods used to estimate the parameters which do not take into account whether the variables are endogenous or exogenous are severely criticized.

### **3. THE STATISTICAL DATA WHICH ARE USED**

In order to determine some features of the public administration reform process in May 2007, a research based on a statistical poll among the public administration was carried out. The research used a representative sample from the civil servants working in the public administration. In order to create the sample we used a two-stage method, and its volume reached the number of 971 civil servants from the central and local public administration. The error of the parameter estimation related to the reference population is of 1,2 percent and the probability that the results are truthful is 97 percent.

A statistical questionnaire was applied to the observed population, including questions which fell into the following major themes: the internal organization of the public administration institutions, the decentralization process in the administration, the public function, the discrimination within this activity sector institutions. In the questionnaire there was also inserted a series of questions regarding personal aspects, such as one's gender and age, preparation level, the kind of institution in which they activate and so on.

Starting from the questionnaire structure, there were defined three categories for the variables based on their aggregation degree.

1. The first level variables have the lowest aggregation degree. Each variable from this category describes a certain degree of the reform process. The values of these variables are determined directly on the basis of the data recorded from the sample. The notation used for them in this writing is the letter  $Q_{...}$ .

For instance,  $Q_{5.22}$  values the degree to which the corruption existing in the system benefits from the shortcomings of the salary system of this activity sector. Besides this variable, on this aggregation level, there is also a series of variables which refer to: the legal framework shortcomings which encourage the corruption within the system, the civil servants liability to do corruption acts, the quality of the economic and political environment to ease the corruption acts and the degree to which the

citizen behaviour encourages the corruption acts. Except for the variables which express personal features, the variables from this aggregation level are defined on the basis of four or five values. For instance, the variable used above can take values in  $\{1,2,3,4,5\}$ . These variables do not explicitly appear in the econometric models but through the variables which are in the second or third aggregation level. In order to define the questions from the questionnaire and at the same time the first level variables, we must take into account the following: (i) similar studies from the specialized literature (Kaufman [2002], Profiroiu [2005] etc); (ii) the analysis of the diagnosis and the reform measures proposed by the public administration reform strategy for the period of 2004 to 2006; (iii) the content of the Phare programme which lasted from 2004 until 2006 and supported the application of the public administration reform process; (iv) the PAL programme of the World Bank etc.

2. The second level variables are calculated by summing up the first level variables and define a certain aspect, not very general if related to the first aggregation level variables of the reform process. These are noted with  $X$  in the model.

3. The third level variables measure a general aspect which concerns the public administration functioning and the implications of the reform process over it. Variables on this level have the highest aggregation level and result from the first and second level variables. These are noted with  $C$  in the model.

The second and third level variables are defined in a way which allows creating a simultaneous equations model that may analyse the following four aspects of the AP reform process at the same time: the AP capacity of accomplishing its basic functions stipulated by the law system, the analysis of some aspects dealing with the transparence of the central (APC) and local (APL) public administration institutions and the examination of the influence factors over the satisfaction of the employees activating in this activity sector.

The most important variables of the research plan are presented in the Appendage no. 1. For each variable we are going to provide a synthetic definition, as well as the number of the first and/or second level variables that were used for calculating it.

#### **4. THE REGRESSION MODELS**

##### **4.1. Analysis models of the institutions performances from APC and APL**

Two regression models are defined using the variables from Annex I to analyse the institutions performances from AP. In both situations the endogenous variable is the one which quantifies the quality of the activity carried on in the public institutions from AP. The parameter estimation, considering the data from each institution, realised in four different situations: (i) public administration level

(AP); (ii) prefect's offices (P); (iii) district councils (CJ); (iv) decentralised offices (SD).

The first regression model analysed the public institution performances on four levels, considering the corruption level and the quality of the courses organised in the AP institutions to promote in public function:

$$C_1 = a_1 + a_5C_5 + a_9C_9 + u_1 \quad [M_1]$$

To estimate the parameter it was used OLS method and was considered only the records (questionnaires) with all the responds. From the total of 971 persons, only 813 mentioned the institution where they work. Using these records had been estimated the model parameters at AP level. If it was took in account the records without the institution name, the total panel will have 873 records, but the estimation are not significant different. The results are presented in Table 1, column 2, values being marked with T.

The second regression model has as explanatory variables: one which measures the corruption level, others which characterise the decision transparency at the level of the institution from AP, satisfaction degree of the employees and the influence of the intern and extern factors which can reduce the corruption:

$$C_1 = a_1 + a_2C_2 + a_3C_3 + a_4C_4 + a_5C_5 + a_6X_6 + a_7C_7 + u_2 \quad [M_2]$$

In the two models, the variables  $u_1$  and  $u_2$  are residual with mean zero and constant variance. These quantify the influence of other factors not included in the model from objective reasons – for example the performance of the institutions from central and local administration.

The parameter estimation was realised in the same conditions as for the first model. For this reason the initial number of values has been reduced from 953 to 878. The results are presented in Table 2.

#### **4.2. Analysis model of the corruption phenomena**

We will define a regression model to analyse the corruption level ( $C_5$ ) in comparison with different factors of influence (i) factors which contribute to the increase of the corruption level. In this category we include: competitions' fraud from FP ( $C_9$ ) and the pressure of the politic system. ( $X_6$ ). (ii) factors which contribute to the reduction of the corruption level. In this category we include: the quality of the activities developed in the AP ( $C_1$ ), institutions, transparency from AP ( $C_2$ ), satisfaction degree of the employees from AP ( $C_3$ ), quality of the relations between workers, actual capacity of AP ( $C_4$ ), to carry out its functions and actual ( $X_8$ ), capacity of the system to finance the public services ( $Q_{3,21}$ ) and the quality of the reform process of FP ( $C_{10}$ ). (iii) the characteristics of the workers from AP. We include three variables in the models: gender ( $C_{11}$ ), management or execution category ( $C_{12}$ ) and educational background ( $C_{13}$ ).

The regression model is defines as follows:

$$C_5 = b_0 + b_1C_1 + b_2C_2 + b_3C_3 + b_4C_4 + b_5Q_{3,21} + b_6X_6 + b_7X_8 + b_8C_9 + b_9C_{10} + b_{10}C_{11} + b_{11}C_{13} + b_{12}C_{14} + u_2 \quad [M_3]$$

where  $u_2$  is a residual variable which quantify the influence over the corruption level of the factors not included in the model.

Parameter estimation was realised at the level of AP, PAC, prefect's offices, CJ and decentralised offices. For each institution was considered only the questionnaires with valid responses to all the variables included in the model. The method used in estimation was OLS and the results are presented in Table 3.

#### 4.3. Analysis models of the transparency in the AP institutions

To define the model used for analysing the transparency can be choose one, two or more variables  $C_2$  or  $C'_2$ . as endogenous. The explanatory variables used in the model can be classified as follows: (i) corruption which encourage the transparency reduction into the public institutions; (ii) variables which describe the specific behaviour of the employees from AP, including here: satisfaction degree of the employees, quality of the relations between workers and the correctness of the promoting process. All these three variables quantify factors in direct correlation with transparency. (iii) variables which quantify elements of the reform process in public administration. These are quantifying factors with positive impact over the increase of transparency in public institutions, if the reform process is felt in the system and a negative impact, if the effects are negative or under employees' expectations. (iv) personal characteristics such as: gender, position in institution, education, etc, which differentiate the persons considering the transparency perception in the public institutions. In these conditions we define the next regression model to analyse the transparency in the AP institutions:

$$C_2 = c_0 + c_1C_1 + c_2C_5 + c_3C_3 + c_4C_4 + c_5X_8 + c_6C_{10} + c_7C_{12} + u_3 \quad [M_4]$$

The parameter estimation was realised using the OLS method and the results are presented in Table 4. For each institution was considered only the questionnaires with valid responses to all the variables included in the model.

#### 4.4. Analysis model of the employees' satisfaction AP

The satisfaction degree of the public officials is a result of the conditions offered at office, the salary obtained as a result of their activities and responsibilities, the respect gained between the colleagues and the results of the reform process from public administration. In the same way, the satisfaction

perception can be different on gender, management and execution categories, on each ones education. In these conditions the regression model used to analyse the employees satisfaction is defined as follows:

$$C_3 = d_0 + d_1C_2 + d_2C_4 + d_3C_9 + d_4C_{10} + d_5C_{11} + d_6C_{12} + d_7C_{13} + u_4 \quad [M_5]$$

The parameter estimation in the four situations (AP, P, CJ and SD) is realised using the three methods known, also for the three regression models estimated above, and the results are presented in Table 5.

## 5. MODEL WITH SIMULTANEOUS EQUATIONS TO ANALYSE THE PHENOMENA FROM AP

Considering the definition of each variable, the data series available, descriptive analysis realised above, the regression models estimated and the literature's approaches Kaufmann [2002], Bai and Wei [2000], Kaufmann, Kraay and Zoido-Lobaton [1999] etc, it can be defined a model with simultaneous equations to analyse the following aspect of the institutions from AP: performances, corruption level, transparency and the satisfaction degree of the employees. To define the four equations of the model we will consider:

$$\text{Institutions performances} = f_1(.)$$

$$\text{Corruption} = f_2(.)$$

$$\text{Transparency} = f_3(.)$$

$$\text{Satisfaction degree of the employees} = f_4(.)$$

The model with simultaneous equation can be written in the next form:

$$C_1 = c(1) + c(2)C_2 + c(3)C_3 + c(4)C_4 + c(5)C_5 + c(6)X_6 + c(7)C_7 + \varepsilon_1 \quad [M_6]$$

$$C_5 = c(8) + c(9)C_1 + c(10)C_2 + c(11)C_3 + c(12)C_4 + c(13)Q_{3,21} + c(14)X_6 + c(15)X_8 + c(16)C_9 + c(17)C_{10} + c(18)C_{11} + \varepsilon_2 \quad [M_7]$$

$$C_2 = c(19) + c(20)C_1 + c(21)C_5 + c(22)C_3 + c(23)C_4 + c(24)X_8 + c(25)X_6 + c(26)X_8 + c(27)C_{10} + c(28)C_{10} + c(29)C_{11} + c(30)C_{12} + \varepsilon_3 \quad [M_8]$$

$$C_3 = c(31) + c(32)C_2 + c(33)C_4 + c(34)C_9 + c(35)C_{10} + c(36)C_{11} + c(37)C_{12} + c(38)C_{13} + \varepsilon_4 \quad [M_9]$$

The endogenous variables of the model are the ones used to quantify the transparency, system transformation as a result of the political changes, employees' satisfaction and the influence of various institutions in reducing the corruption level. The other variables are considered exogenous.

## 6. COMMENTS

The utilization of the model with simultaneous equations to analyse the corruption has some advantages concerning the parameter estimation. In this model is taken in account the exogenous character of the variables and the parameters

estimated are not displaced and consistent. The following aspects are important in this case: (i) variables separation in exogenous and endogenous; (ii) the right selection of the estimation method (iii) if for estimation is used least-squared method in two stages, it is important to choose correctly the instrumental variables (see Kaufmann (1999)).

The model with simultaneous equation defined above can be identifying because the number of the excluded variables is higher than the one of endogenous variables. The model parameters are estimated through the least-squared method in two stages (TSLS) and General Method of Moments (GMM). Using these analysis instruments we take in account the endogenous or exogenous character of each variable. In the economic literature isn't a suitable approach in choosing the instrumental variables for the models with simultaneous equation (Bai and Wei [2000]; Kaufmann, Kraay and Zoido-Lobaton [1999]). In the corruption analysis using the econometric models and where the parameters are estimated using data from a simple sample are important the following aspects: (i) correct definition of the questions from the statistical instrument applied to the statistical population; (ii) correct aggregation of the primary variables in the process to obtain the aggregate variables of different orders. In this analysis were used primary and aggregate variables by order one and two. In Annexe I are presented all the variables used in the models.

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## Econometric Models Used for the Corruption Analysis

	AP		APC		CJ		P		SD	
	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters
Constant		4.208* (0.095)	4.209 <sup>T</sup> (0.092)	4.664* (0.296)		3.921* (0.142)		3.957* (0.254)		4.169* (0.119)
C5	-0.271*	-0.171* (0.028)		-0.357* (0.085)	-			-0.329*	-0.262* (0.084)	-0.271* (0.035)
C9	-0.280*	-0.178 <sup>T</sup> (0.027)		-0.218** (0.092)	-0.425*	-0.305* (0.065)			-0.257*	-0.165* (0.036)
$R^2$		0.346		0.411		0.425		0.329		0.331
$F$		55.146	55.15 <sup>T</sup>	11.56		22.212		9.827		31.292
Number of cases		813	873 <sup>T</sup>	116		102		85		510
Number of valid cases		882	971 <sup>T</sup>	134		113		89		546

**Table 1: Analysis of the quality of the activity of public administration institutions in relation to corruption factors**

\* differs considerably from zero for a significance threshold of 1%; \*\* 2%



	AP		APC		CJ		P		SD	
	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters
Constant		2.369 <sup>*</sup> , 2.398 <sup>*T</sup> (0.244) (0.237)		2.332 <sup>*</sup> (0.794)		1.390 <sup>*</sup> (0.380)		2.467 <sup>*</sup> (0.449)		3.048 <sup>*</sup> (0.242)
C3	0.336 <sup>*</sup>	0.169 <sup>*</sup> , 0.179 <sup>*T</sup> (0.036) (0.035)	0.382 <sup>*</sup>	0.262 <sup>****</sup> (0.131)	0.380 <sup>*</sup>	0.230 <sup>***</sup> (0.099)			0.557 <sup>*</sup>	0.196 <sup>*</sup> (0.044)
C4	0.305 <sup>*</sup>	0.209 <sup>*</sup> , 0.211 <sup>*T</sup> (0.045) (0.044)		0.396 <sup>*</sup> (0.151)	0.434 <sup>*</sup>	0.337 <sup>*</sup> (0.126)				
C5	-0.207 <sup>*</sup>	-0.096 <sup>*</sup> , -0.102 <sup>*T</sup> (0.029) (0.028)		-0.215 <sup>*</sup> (0.100)			-0.301 <sup>*</sup>	-0.158 <sup>*****</sup> (0.048)	-0.275 <sup>*</sup>	-0.117 <sup>*</sup> (0.038)
C7	-0.235 <sup>*</sup>	-0.061 <sup>**</sup> , -0.062 <sup>**</sup> (0.025) (0.025)							-0.320 <sup>*</sup>	-0.107 <sup>*</sup> (0.030)
X8	0.214 <sup>*</sup>	0.099 <sup>*</sup> , 0.080 <sup>*T</sup> (0.035) (0.034)					0.348 <sup>*</sup>	0.407 <sup>*</sup> (0.117)	0.204 <sup>*</sup>	0.083 <sup>****</sup> (0.043)
C10	-0.129 <sup>*</sup>	-0.110 <sup>**</sup> , -0.102 <sup>**T</sup> (0.045) (0.044)	-0.232 <sup>*</sup>	-0.329 <sup>**</sup> (0.139)	0.190 <sup>*</sup>					
C12	0.205 <sup>*</sup>	0.170 <sup>*</sup> , 0.152 <sup>*T</sup> (0.046) (0.045)	0.230 <sup>*</sup>		0.255 <sup>*</sup>	0.200 <sup>*****</sup> (0.111)	0.189 <sup>***</sup>	0.368 <sup>***</sup> (0.167)	0.193	0.158 <sup>*</sup> (0.057)
R <sup>2</sup>		0.464, 0.211 <sup>T</sup>		0.584		0.501		0.493		0.445
F		29.899, 30.684 <sup>T</sup>		11.101		10.610		7.932		23.282
Number of vapid cases		768, 808 <sup>T</sup>		90		98		77		477

**Tabelul 2. Analysis of the quality of the activity of public administration institutions**

\* differs considerably from zero for a significance threshold of 1%; \*\* 2%; \*\*\* 3%; \*\*\*\* 5% \*\*\*\*\* .6% \*\*\*\*\* 8%

## Econometric Models Used for the Corruption Analysis

	AP		APC		CJ		P			
	Coef. of correlation	Parameters M3.1AP	Parameters M3.2AP	Coef. of correlation	Parameters M3.1APC	Parameters M3.2APC	Coef. of correlation	Parameters	Coef. of correlation	Parameters M3.1P
Constant		3.080* (0.250)	3.621* (0.262)		4.273* (0.382)	4.485* (0.628)		3.805* (0.508)		3.990* (0.544)
C2	-0.323*		-.166* (0.034)	-0.464*	-0.292* (0.071)				-0.295*	-0.189*** (0.092)
C3	-0.222*	-0.081*** (0.039)							-0.258****	-0.239**** (0.128)
Q3.21	-0.183**	-0.053**** (0.031)		-0.323*	-0.266*** (0.093)	-0.231*** (0.104)				
C4	-0.185*		-0.095* (0.038)	-0.272*		-0.294**** (0.137)	-0.224****	-0.234**** (0.127)		
Q5.22	-0.193*	-0.099* (0.029)	-0.097* (0.028)	-0.317*		-0.146*** (0.087)	-0.164****	-0.135**** (0.074)	-0.227*	
X6	0.232*	0.095* (0.025)	0.094* (0.024)	0.261*	0.118*** (0.056)	0.123*** (0.060)				
C7	0.277*	0.136* (0.031)	0.113* (0.030)	0.335*		0.156**** (0.081)				
X8	-0.195*	-0.107** (0.044)	-0.094*** (0.042)							
C9	0.257*	0.142* (0.034)	0.111* (0.034)	0.325*	0.162**** (0.089)		0.197****	0.156**** (0.088)	0.269****	0.206*** (0.101)
C10	0.118*	0.113*** (0.053)	0.103* (0.052)							
$R^2$		0.438	0.460		0.581	0.528		0.224		0.421
$F$		21.210	24.721		12.889	7.795		4.96		5.245
Number of cases		744	744		105	105		95		76

**Table 3. Model for the analysis of corruption**

	P			SD			
	Coef. of correlation	Parameters M3.2P	Parameters M3.3P	Coef. of correlation	Parameters M3.1SD	Parameters M3.2SD	Parameters M3.3SD
Constant		3.843* (0.521)	4.747* (0.494)		3.262* (0.261)	3.436* (0.262)	3.254* (0.235)
C2	-0.295*		-0.189* (0.093)	-0.324*	-0.178* (0.044)	-0.188* (0.045)	-0.198* (0.045)
C3	-0.258****	-0.285*** (0.127)	-0.257* (0.129)				
Q5.22	-0.227*	-0.146**** (0.074)	-0.131* (0.075)	-0.142*			-0.069**** (0.038)
X6				0.249*	0.126* (0.031)		
C7				0.304*	0.152* (0.039)	0.157* (0.040)	0.162* (0.039)
X8				-0.197*	-0.114* (0.052)	-0.122** (0.053)	
C9	0.269****	0.223*** (0.100)		0.248*	0.106* (0.043)	0.136* (0.043)	0.137* (0.043)
$R^2$		0.417	0.407		0.451	0.417	0.413
$F$		5.115	4.826		23.510	24.311	23.723
Number of cases		76	76		465	465	465

**Table 3 continued**

\* \* differs considerably from zero for a significance threshold of 1%; \*\* 2%; \*\*\* 3%; \*\*\*\* 5% \*\*\*\*\*.6% \*\*\*\*\* 8%

\* differs considerably from zero for a significance threshold of 1%; \*\* 2%; \*\*\* 3%; \*\*\*\* 5% \*\*\*\*\*.6% \*\*\*\*\* 8

## Econometric Models Used for the Corruption Analysis

	AP		APC		CJ		P		SD	
	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters
Constant		0.414*** (0.218)		0.602 (0.640)		-0.541* (0.358)		0.157* (0.455)		0.555* (0.283)
C1	0.697*	0.703* (0.035)	0.763*	0.729* (0.094)	0.754*	0.723* (0.090)	0.593*	0.697* (0.127)	0.692*	0.669* (0.044)
C3	0.393*	0.124* (0.034)			0.412*	0.214** (0.081)			0.412*	0.141* (0.044)
C4	0.318*	0.106** (0.041)	0.444*	0.231** (0.131)					0.283*	0.083* (0.050)
C5	-0.368*	-0.112* (0.027)	-0.563*	-0.237* (0.084)					-0.360*	-0.107* (0.034)
X8					0.415*	0.216*** (0.095)	0.354*	0.248** (0.141)		
C10	-0.289*	-0.056** (0.021)							-0.356*	-0.069**** (0.028)
C11					-0.233*	-0.090*** (0.042)				
C12	0.238*	0.108**** (0.042)							0.279*	0.169* (0.054)
$R^2$		0.736		0.800		0.797		0.614		0.742
$F$		141.28		50.87		36.96		22.44		86.39
Number of cases		725		89		98		76		430

**Table 4. Analysis of transparency in public administration**

\* differs considerably from zero for a significance threshold of 1%; \*\* 2%; \*\*\* 3%; \*\*\*\* 5% \*\*\*\*\* .6% \*\*\*\*\* 8

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	AP		APC		CJ		P		SD	
	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters	Coef. of correlation	Parameters
Constant		2.093*** (0.220)		2.976 (0.587)		1.098* (0.417)		2.839* (0.601)		1.773* (0.262)
C2	0.393*	0.183* (0.032)	0.489*	0.125* (0.070)	0.412*	0.155** (0.089)			0.412*	0.207* (0.040)
C4	0.364*	0.278* (0.044)	0.384*	0.268** (0.121)	0.462*	0.416** (0.119)	0.351*	0.345** (0.136)	0.353*	0.264* (0.052)
C5	-0.284*	-0.062** (0.031)	-0.458*	-0.143** (0.082)			-0.335*	-0.203* (0.087)		
X6	-0.209*	-0.086* (0.027)	-0.403*	-0.129* (0.076)	-0.257*	-0.158** (0.062)			-0.182*	-0.064* (0.033)
X7			-0.360*	-0.141** (0.082)	0.107*	0.206** (0.087)				
C7	-0.262*	-0.060* (0.023)								
C8	0.184*	0.041** (0.023)			0.287*	0.177** (0.064)			0.226*	0.079**** (0.027)
C9									-0.241*	-0.074* (0.039)
C10									-0.303*	-0.074* (0.029)
C11									0.127*	0.070* (0.032)
C12	0.150*	0.085**** (0.046)								
$R^2$		0.509		0.625		0.620		0.428		0.534
$F$		33.87		10.79		10.51		8.278		24.45
Number of cases		685		89		89		76		436

**Table 5. Analysis of the degree of satisfaction of public administration employees**

\* differs considerably from zero for a significance threshold of 1%; \*\* 2%; \*\*\* 3%; \*\*\*\* 5% \*\*\*\*\* 6% \*\*\*\*\* 8

## Econometric Models Used for the Corruption Analysis

### Annex 1: Level-two and three aggregate variables used to define econometric models

Current no.	Variable	Definition of the variable	Number of aggregate variables	
			Level 1	Level 2
1	Quality of the activities carried out by public administration institutions – $C_1$	It is a characteristic that takes into consideration three aspects related to the functioning of a public administration institution: the knowledge of the purposes, objectives and development strategy, the budgetary performances and the quality of the relations with the beneficiaries of the services provided.	9	3
2	Transparency at the level of public administration institutions – $C_2$ or $C'_2$	It is a variable that characterises the existence, application and monitoring of the rules regarding the decision-making process and the access of employees and beneficiaries to the public information of public administration institutions.	5	2
3	Pressure put by the political system ( $X_6$ )	It measures the impact of the political system on the trade-union movement of public administration, on the recruitment to a managerial or non-managerial position in local and central public administration institutions.	4	-
4	Transformations in the system due to political changes ( $X_7$ )	This variable is defined in relation to the changes in public administration as a result of local or general elections, changes that took place at the level of budgetary management, the management of services and staff policy.	3	-
5	Capacity of local public administration to fulfil its functions ( $X_8$ )	It is a variable defined in relation to the capacity of public administration to fulfil its ten functions set out in the law: the management of public goods and public funds at local level, the provision of public services in the fields of health, social assistance, education, culture, public order, civil protection, forecasting and socio-economic development, and organisational capacity.	10	-
6	Satisfaction of public administration employees ( $C_3$ )	It is a variable calculated based on the satisfaction of the employees with the following aspects: monthly average income, the respect of colleagues, citizens, the direct boss, the managerial staff of the institution, and the working conditions in which they carry out their activities.	8	3
7	Quality of work relations ( $C_4$ )	It is a variable defined based on the quality of the work relations with colleagues from the same department and from other departments, the direct boss and the head of the institution, clients and persons from other similar institutions with whom they come in contact..	6	-
8	Level of corruption	It is a variable that measures the level of corruption in the public sector from the	6	-

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	(C <sub>5</sub> )	perspective of public administration employees.		
9	Effects of corruption at economic and social level (C <sub>6</sub> )	It is a variable that takes into consideration the negative effects of corruption on the economic and social development of a locality and on the development of some services at national level.	7	-
10	Influence of the factors that contribute to reducing corruption (C <sub>7</sub> )	This variable quantifies the contribution of various factors to the reduction of corruption: media, school, church, political class, civil servants and citizens.	8	-
11	Action of the factors that contribute to reducing corruption (C <sub>8</sub> )	An aggregate variable which measures the efficiency of the factors that lead to the reduction of corruption	8	-
12	Fairness of the competitions for recruitment/promotion to the civil service (C <sub>9</sub> )	It is a variable that provides information on important aspects related to the recruitment and promotion to the civil service, such as the influence exercised through various channels and the poor organisation of the competitions.	8	-
13	Quality of civil service reform (C <sub>10</sub> )	It is a variable that measures the influence exercised by the reform process on important aspects of the civil service, such as getting young people interested in applying for civil servant positions, increasing the mobility of civil servants, the continuing vocational training and the contribution to the reduction of corruption.	6	-
14	Personal characteristics (C <sub>11</sub> – C <sub>15</sub> )	The person's gender (C <sub>10</sub> ), age in completed years (C <sub>11</sub> ), staff category (managerial or non-managerial staff) (C <sub>12</sub> ), level of training (high school studies, post high school studies, college degree, master's, PhD) (C <sub>13</sub> ), the person's religion (C <sub>14</sub> ) and the type of institution in which the person carries out his/her activities (central public administration, Prefects' Offices, County Councils and decentralised services) (C <sub>15</sub> ).	-	-